



The Lubrizol Corporation

Site Specific Quality Assurance Project Plan

Greiner's Lagoon

Ballville Township, OH

July 2006

ERM Project No. 0047810

Environmental Resources Management

30775 Bainbridge Road, Suite 180

Solon, OH 44139

(440) 542-0750

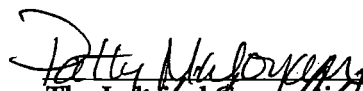

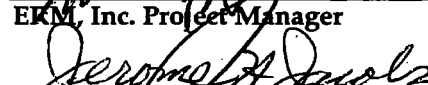
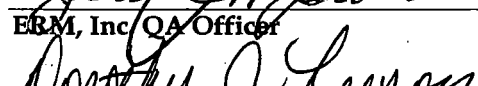
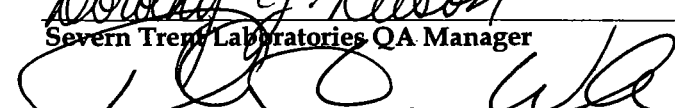
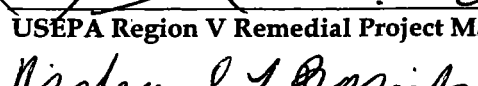
www.erm.com

The Lubrizol Corporation

Site Specific Quality Assurance Project Plan

Griener's Lagoon
Ballville Township, Ohio

July 2006

| | |
|--|-----------|
|  | 10/3/06 |
| The Lubrizol Corporation Project Manager | Date |
|  | 7/31/06 |
| ERM, Inc. Project Manager | Date |
|  | 7/31/06 |
| ERM, Inc. QA Officer | Date |
|  | 10/10/06 |
| Severn Trent Laboratories QA Manager | Date |
|  | 9/14/06 |
| USEPA Region V Remedial Project Manager | Date |
|  | 9/14/06 * |
| USEPA Region V Quality Assurance Reviewer | Date |

* Conditional Approval

Environmental Resources Management
30775 Bainbridge Road, Suite 180
Solon, OH 44139
(440) 542-0750
www.erm.com

TABLE OF CONTENTS

| | | |
|------------|--|-----------|
| 1.0 | PROJECT DESCRIPTION | 1 |
| 1.1 | INTRODUCTION | 1 |
| 1.2 | SITE DESCRIPTION AND HISTORY | 1 |
| 1.3 | TARGET PARAMETERS | 4 |
| 1.4 | PROJECT OBJECTIVES | 4 |
| 1.5 | SAMPLE NETWORK AND RATIONALE | 5 |
| 1.6 | PROJECT SCHEDULE | 5 |
| 2.0 | PROJECT ORGANIZATION AND RESPONSIBILITY | 6 |
| 2.1 | OVERALL MANAGEMENT AND QA/QC RESPONSIBILITIES | 6 |
| 3.0 | QA OBJECTIVES FOR MEASUREMENT DATA IN TERMS OF PRECISION, ACCURACY, COMPLETENESS, REPRESENTATIVENESS, AND COMPARABILITY | 10 |
| 3.1 | OVERALL PROJECT OBJECTIVES | 10 |
| 3.2 | FIELD INVESTIGATION QUALITY OBJECTIVES | 10 |
| 3.3 | LABORATORY QUALITY OBJECTIVES | 12 |
| 3.4 | DATA MANAGEMENT OBJECTIVE | 13 |
| 4.0 | SAMPLING PROCEDURES | 14 |
| 4.1 | SAMPLING RATIONALE | 14 |
| 4.2 | SAMPLING PROTOCOL SUMMARY | 14 |
| 4.3 | SAMPLE PACKING, HANDLING AND SHIPMENT | 14 |
| 4.4 | SAMPLE CONTAINERS, PRESERVATIVES AND HOLDING TIMES | 15 |
| 4.5 | PREPARATION OF SAMPLING EQUIPMENT AND CONTAINERS | 15 |

| | | |
|-----|---|----|
| 4.6 | CHAIN OF CUSTODY PROCEDURE | 15 |
| 4.7 | DOCUMENTATION OF SAMPLING ACTIVITIES | 16 |
| 4.8 | SUMMARY OF SAMPLING AND ANALYSES | 17 |
| 5.0 | SAMPLE CUSTODY | 18 |
| 5.1 | FIELD ACTIVITIES - SAMPLING AND MEASURING | 18 |
| 5.2 | LABORATORY ANALYSIS | 19 |
| 5.3 | FINAL EVIDENCE FILE | 20 |
| 6.0 | CALIBRATION PROCEDURES AND FREQUENCY | 21 |
| 6.1 | FIELD INSTRUMENTS | 21 |
| 6.2 | LABORATORY INSTRUMENTS | 23 |
| 7.0 | ANALYTICAL PROCEDURES | 24 |
| 7.1 | SAMPLE PREPARATIONS | 24 |
| 7.2 | INSTRUMENT START-UP AND PERFORMANCE CHECK | 24 |
| 7.3 | DETECTION LIMITS FOR PARAMETERS TO BE TESTED | 24 |
| 7.4 | INITIAL CALIBRATION AND CONTINUING CALIBRATION CHECK | 24 |
| 7.5 | ANALYTICAL PROCEDURES FOR EACH SAMPLE MATRIX AND/OR PARAMETERS | 24 |
| 7.6 | CHAIN-OF-CUSTODY PROCEDURE | 25 |
| 8.0 | DATA REDUCTION, VALIDATION, AND REPORTING | 26 |
| 9.0 | INTERNAL QUALITY CONTROL CHECKS | 28 |
| 9.1 | LABORATORY INTERNAL QUALITY CONTROL CHECKS | 28 |
| 9.2 | FIELD INTERNAL QUALITY CONTROL CHECKS | 28 |
| 9.3 | LABORATORY INTERNAL QUALITY CONTROL CHECKS | 29 |

| | | |
|-------------|--|-----------|
| 10.0 | PERFORMANCE AND SYSTEM AUDITS | 30 |
| 10.1 | ON-SITE AUDIT | 30 |
| 10.2 | INTERNAL AUDIT | 30 |
| 11.0 | PREVENTIVE MAINTENANCE | 32 |
| 11.1 | LABORATORY MAINTENANCE | 32 |
| 11.2 | FIELD MAINTENANCE | 32 |
| 12.0 | SPECIFIC ROUTINE PROCEDURES USED TO ASSESS DATA PRECISION, ACCURACY, AND COMPLETENESS | 33 |
| 12.1 | OVERALL PROJECT ASSESSMENT | 33 |
| 12.2 | FIELD QUALITY ASSESSMENT | 33 |
| 12.3 | LABORATORY DATA QUALITY ASSESSMENT | 33 |
| 12.4 | ERM'S LABORATORY DATA ASSESSMENT | 34 |
| 12.5 | DATA MANAGEMENT QUALITY ASSESSMENT | 34 |
| 13.0 | CORRECTIVE ACTION | 36 |
| 13.1 | STL'S CORRECTIVE ACTION | 36 |
| 13.2 | ERM'S CORRECTIVE ACTION | 36 |
| 14.0 | QUALITY ASSURANCE REPORT TO MANAGEMENT | 37 |

LIST OF TABLES

| | |
|----------------|--|
| Table 1 | <i>Data Quality Indicators Definitions</i> |
| Table 2 | <i>Data Quality Objectives for Precision and Accuracy</i> |
| Table 3 | <i>Surrogate Spike Control limits for Accuracy Objectives</i> |
| Table 4 | <i>Requirements for Containers, Preservation Holding Times, and Sample Volumes.</i> |
| Table 5 | <i>Conductivity Temperature Corrections</i> |
| Table 6 | <i>Standard Operating Procedures</i> |
| Table 7 | <i>Chemical Analysis to be conducted on Samples</i> |

LIST OF FIGURES

| | |
|-----------------|---------------------------------|
| Figure 1 | <i>Site Location Map</i> |
| Figure 2 | <i>Site Plan</i> |

1.0 PROJECT DESCRIPTION

1.1 INTRODUCTION

This Quality Assurance Project Plan (QAPP) sets forth procedures to assure that the quality of the samples collected and analyzed; the quality, quantity, and validity of data stored and managed, and the reports written meet the project needs for the Greiner's Lagoon Site, Fremont, Ohio (Site). This plan presents the organization, objectives, functional activities, and specific sampling and analysis quality assurance (QA) and quality control (QC) procedures under which actions will be performed.

Monitoring will be done by collecting data specified in the Site Specific Sampling and Analysis Plan (SAP) found in Attachment III of the Operation and Maintenance Manual.

At a minimum, all sampling and analysis data will be consistent with applicable requirements set forth in U.S. EPA SW-846 (Test Methods for Evaluating Solid Waste, Third Edition). The samples collected at the Site will be analyzed to produce data of sufficient quality to evaluate the effectiveness of the Remedial Action. When specified criteria are not met due to a variety of sample matrix-related reasons, the data will be carefully evaluated to determine if certain aspects of this data can still be used to meet the project objectives.

1.2 SITE DESCRIPTION AND HISTORY

The Site is located south of Fremont, Ohio, on County Road 181 about 1/2 mile west of Tiffin Road in Ballville Township, Sandusky County, Ohio. Figure 1 shows the Site location. The Site was originally developed by Mr. Terry Little in 1954, and consisted of four lagoons to store waste oil collected from nearby industry. A letter from the community, sent to Mr. Little in 1960, complained of odors emanating from the lagoon and of animals being killed or trapped by the oil. In response to the complaints from the community, Ohio EPA ordered Mr. Little to cease dumping oil into the four lagoons in 1970.

In 1972, Mr. Little traded the property to Beatrice and Edgil Collins in return for well drilling services. The Collins then sold the property to Mr.

Nobel Caseman in 1973. During Mr. Caseman's period of ownership, a lawsuit was filed by members of the community against the original owner, Mr. Terry Little. By order of the Sandusky County Court of Common Pleas, Mr. Little was required to take measures to prevent any release of oil from the Site. In response, Mr. Little constructed dike systems around the four lagoons.

In the latter part of 1973, Mr. Caseman sold the property to Gary Greiner, the present owner. From 1973 until the latter part of 1974, Mr. Greiner used the Site for disposal of demolition debris. In November of 1974, the Ohio EPA ordered Mr. Greiner to clean up the Site. Because Mr. Greiner failed to comply with the order, the case was referred to the Ohio Attorney General who filed a suit in the Sandusky Court of Common Pleas in 1975. A judgment was handed down in September, 1980, ordering Mr. Greiner to clean up the Site by January 15, 1981. Mr. Greiner did not comply with the order.

On June 16, 1981, heavy rains caused the lagoons to overflow. Oil contaminated with polychlorinated biphenyls (PCBs) was released onto the adjoining farm land and into a nearby drainage ditch. Some of the contaminated oil flowed into Indian Creek via the drainage ditch and eventually to the Sandusky River. On June 17, 1981, the U.S. EPA reinforced the dikes around the lagoons. A dike was also built to contain a previous spill in a low area around the lagoons.

In June of 1981, surface oil was collected from the lagoons and stored on-site in two tanks totaling 12,000 gallons. Liquid from Lagoons 3 and 4 was siphoned off and passed through a carbon contact unit that was constructed on-site in a 20,000 gallon tank. Effluent from the carbon unit was discharged to the nearby drainage ditch. Lagoon 4 was dewatered, filled and capped. Closure and grading of this lagoon was completed in June 1982, as a CERCLA-funded immediate removal action. Another action undertaken as part of this cleanup was the partial dewatering of Lagoon 3.

Between the summers of 1982 and 1985, Ohio EPA coordinated the delivery of several truckloads of "sugar beet fines," sand and gravel washings from the cleaning and processing of sugar beets, and dumping of the fines in the remaining open lagoons. Lagoons 1 and 2 were filled in.

In May, 1986, Lagoon 3 again overtopped the western dike. U.S. EPA then undertook an immediate removal action to build up the freeboard of the lagoon and prevent the off-site migration of contaminants. Sandbags

were used to construct a temporary retention dam and to raise the level of the western dike.

In the fall of 1987, the U.S. EPA undertook a removal action that consisted of the following:

- On-site treatment and discharge of impounded water
- Stabilization of oils and sludges in Lagoon 3
- Consolidation of Lagoon 3 stabilized material on former Lagoons 1 and 2
- Covering of all stabilized material with soil
- Site regrading

These removal action activities were completed in June, 1988. The actions completed to date have resulted in the temporary stabilization of the Site.

The available information about U.S. EPA's removal actions indicates that Lagoon 3 had an area of approximately 4,300 square yards and a depth of about 4 feet. It is estimated that about 5,000 cubic yards of water, oil, and sludge were removed from Lagoon 3 during U.S. EPA's actions. The Agency's activities at the Site indicated the presence of arsenic, barium, chromium, cobalt, lead, nickel, phenol, PCBs, and toluene in Site materials.

During August 1991, Lubrizol arranged for the removal of the access road adjacent to the Site. As part of the road removal, a drainage ditch was relocated onto the Site, and a portion of the adjacent property was regraded to promote drainage. In addition, in late August 1991, Lubrizol arranged for the installation of a fence on the Site for security.

Based on the results of the Engineering Evaluation/Cost Analysis (EE/CA) site investigations and risk assessment, phytoremediation was selected as the preferred removal action for the Site. Phytoremediation is the use of plants to promote remediation of soil and/or ground water, to prevent soil erosion, and to control infiltration into and from subsurface strata.

Phytoremediation was recommended to be implemented at the Site using a tall grass cover and a groundwater tree barrier. The area to be covered at the Site was 3.2 acres, which was to be fenced to control access to the site and to help ensure the long-term integrity of the phytoremediation system. All existing vegetation was to be cleared from the former lagoon areas. The northern portion of the Site was to be amended with soil to

improve subsoil quality in the soft areas that had formerly been filled by USEPA and OEPA. One foot of topsoil was to be placed over the regraded soils to help promote rapid root development and to minimize exposure to bare areas. The design of the phytoremediation cover included surface water management through the use of drainage ditches and site grading to reduce water infiltration into the effected areas. Switchgrass was to be used as the vegetation for the phytoremediation cover. Hybrid poplars were to be used for the phytoremediation groundwater tree barrier.

The installation of a phytoremediation system using tall grass cover and a groundwater tree barrier was initiated in July 2005, with the majority of the field construction completed by November 2005.

1.3 TARGET PARAMETERS

The target parameters for this project were identified based upon the results of previous investigation. Constituents detected in previous investigation are Volatile Organic Compounds, semiVolatile Organic Compounds, and Metals.

1.4 PROJECT OBJECTIVES

The objective of the Remedial Action is to mitigate the risks to human health and the environment as defined in the EE/CA. The human health risk assessment identified the following risks slightly above USEPA threshold values:

- Carcinogenic Risks – Exposure to On-Site Soil by the Future Construction Worker and Adolescent Trespasser
- Non-Carcinogenic Risks – Exposure to On-Site Soil by the future Construction Worker and Exposure to On-Site Shallow Ground Water to the Future Construction Worker.

The risk assessment determined that there are no off-site risks posed by the Site. The on-site risks to the future construction worker and to the adolescent trespasser will be mitigated through the use of site controls (fencing), soil cover, phytoremediation, and institutional controls. The removal action will provide for short- and long-term minimization of the potential for human exposure to constituents of concern at levels that

would result in calculated risks above USEPA threshold values for the Site. The RA will be implemented to the extent practical in accordance with applicable, or relevant and appropriate requirements (ARARs). The selection of ARARs is dependent on the hazardous substances present at the Site, site characteristics and the activities required to implement the RA. Based on the use of phytoremediation as the preferred RA the following ARARs are selected for the Site:

1. USEPA MCLs as specified by the Safe Drinking Water Act for groundwater.
2. PCBs in waste remaining on site at concentrations not greater than 100 mg/kg in soil for fenced and capped areas with deed restrictions.
3. PCBs in waste remaining on site at concentrations not greater than 50 mg/kg in soil for fenced and capped areas without deed restrictions.
4. Requirements per 40 CFR 264.310(a) for closure of landfills to function with minimum maintenance.
5. Requirements per 40 CFR 264.320(a) for closure of landfills to promote drainage and minimize erosion or abrasion of the cover.
6. Requirements per 40 CFR 264.117(c) for closure of landfills to restrict post-closure use of the property by restricting access and providing ongoing security.
7. Requirements per 40 CFR 264.228(b) and 40 CFR 264.310(b) for closure of landfills to prevent run-on and run-off from damaging the cover.

1.5 *SAMPLE NETWORK AND RATIONALE*

The site monitoring activities planned for the Greiner's Lagoon Site are detailed in the Sampling and Analysis Plan (SAP) found in Attachment III of the Operation and Maintenance Manual.

1.6 *PROJECT SCHEDULE*

The anticipated schedule for the sampling and analysis at the Greiner's Lagoon Site is projected for 5 years of annual sampling.

2.0

PROJECT ORGANIZATION AND RESPONSIBILITY

QA/QC procedures must be strictly adhered to in order to ensure the production of the highest quality data. Two organizations will have responsibilities for implementing portions of this QAPP. ERM, Inc. has been retained to conduct the Site investigation activities. Severn Trent Laboratories, Inc. /STL North Canton (STL) will conduct chemical analyses. Analytical data for this investigation will have two separate reviews for validity and usability. STL will technically review the analytical data prior to release. All analyses will be conducted at STL, 4101 Shuffel Dr., N.W., North Canton, OH, 44720, telephone - (330) 497-9396. ERM will perform data validation to determine validity and fitness for use with appropriate qualifications. The organization and responsibilities of individuals and organizations implementing the procedures specified in this QAPP are described in the following subsections.

2.1

OVERALL MANAGEMENT AND QA/QC RESPONSIBILITIES

General responsibilities of the individuals responsible for QA/QC are described in the following sections.

2.1.1

ERM, Inc. Project Manager

Mr. William Lozier of ERM, Inc. is the Project Manager for the site. In this role, he has overall project responsibility and direct responsibility for the management of staff involved in this project. Specific duties are as follows:

- Implementing project plans
- Coordinating project activities
- Coordinating project personnel and staffing
- Completing project deliverable reviews
- Providing input on technical direction

2.1.2 *ERM, Inc. Project QA/QC Manager*

Mr. Jerry Jacobs of ERM, Inc. is the Project Quality Assurance Manager for this investigation. He will be responsible for ensuring that field and laboratory activities and analyses are conducted in accordance with the QAPP. Specific responsibilities include the following:

- Direct performance and system audits
- Review all documents with respect to adherence to QA procedures provided in the QAPP
- Preparation of analytical data tables and quality assurance reviews
- Recommend and institute corrective actions based on reviews and audits

2.1.3 *ERM, Inc. Site Manager*

Ms. Sarah Clark of ERM, Inc., or an alternate designated by the Project Manager, is the Site Manager for this project and will be responsible for on-Site activities including drilling, sampling, and health and safety. Specific activities include the following:

- Ensure that field activities are conducted in accordance with the Site Specific Sampling Plan, QAPP, and Health and Safety Plan
- Review and evaluate field records
- Subcontractor coordination
- Oversight of field staff

2.1.4 *Patrick O'Meara - Project Manager - STL, Inc.*

- Ensure all resources of the laboratory are available on an as-required basis
- Overview of final analytical reports

2.1.5 *Ray Ridsen - Operations Manager - STL, Inc.*

- Coordinate laboratory analyses
- Supervise in-house chain-of-custody
- Schedule sample analyses
- Oversee data review
- Oversee preparation of analytical reports

2.1.6 ***Dorothy J. Leeson - QA Manager - STL, Inc.***

- Overview laboratory quality assurance
- Overview QA/QC documentation
- Decide laboratory corrective actions, if required
- Technical representation of laboratory QA procedures
- Preparation of laboratory SOPs
- Approval of the QAPP

2.1.7 ***John McFadden - Sample Custodian - STL, Inc.***

- Receive and inspect the incoming sample containers
- Record the condition of the incoming sample containers
- Sign appropriate documents
- Verify correctness of chain-of-custody documents
- Notify appropriate laboratory personnel of sample receipt and inspection
- Assign a unique identification number and customer number, and enter each into the sample receiving log
- Control and monitor access/storage of samples and extracts

A final data package including all raw data will be submitted to the Project QA/QC Manager for a rigorous quality assurance review.

2.1.8 ***US. EPA Region V Remedial Project Manager***

Tom Williams is the U.S. EPA Region V Remedial Project Manager for the Greiner's Lagoon Site. His responsibilities include:

1. Technical review and approval of all plans and data submitted.
2. Coordination of activities with the Lubrizol Project Coordinator.

2.1.9 ***Ohio EPA Project Coordinator***

Mr. Ghassan Tafla is the Ohio EPA Northwest District Office, Project Coordinator for the Greiner's Lagoon Site. Mr. Tafla will provide technical review of the work performed.

2.1.10 USEPA Region V QAR

The USEPA Region V Quality Assurance Representative is responsible for review of the QAPP and all deliverables for the project.

3.0 QA OBJECTIVES FOR MEASUREMENT DATA IN TERMS OF PRECISION, ACCURACY, COMPLETENESS, REPRESENTATIVENESS, AND COMPARABILITY

3.1 OVERALL PROJECT OBJECTIVES

Data Quality Objectives (DQO) are quantitative and qualitative statements specifying the quality of the environmental data required to support the decision making process. DQOs for measurement data are expressed in terms of accuracy, precision, completeness, representativeness, and comparability. DQOs define the degree of total uncertainty in the data that is acceptable for each specific activity during the monitoring. This uncertainty includes both sampling error and analytical error. Ideally, the prospect of zero uncertainty is the intent; however, the variables associated with the process (field and laboratory) inherently contribute to the uncertainty of the data. It is the overall objective to keep the total uncertainty within an acceptable range that will not hinder the intended use of the data. In order to achieve this objective, specific data quality requirement such as detection limits, criteria for accuracy and precision, sample representativeness, data compatibility and data completeness will be specified. The overall objectives and requirements will be established such that there is a high degree of confidence in the measurements. The specific analytical parameters for the samples collected during the investigation are specified in Section 7 of this QAPP.

As stated earlier, the criteria that will be used to specify data quality requirements and to evaluate the analytical system performance are precision, accuracy, representativeness, completeness and comparability (PARCC). Table 1 presents definitions for these criteria.

3.2 FIELD INVESTIGATION QUALITY OBJECTIVES

The objectives with respect to the field investigation are to maximize the confidence in the data in terms of PARCC. In terms of precision and accuracy, Section 9 presents the frequency with which field duplicates and field blanks will be collected such that the specific degree of precision and accuracy can be calculated. The data quality objective for field duplicates is to achieve precision equal to or greater than laboratory duplicate precision requirements.

Table 1 ***Data Quality Indicators Definitions***

| | |
|---------------------------|---|
| Precision | a measure of the reproducibility of measurements under a given set of conditions. |
| Accuracy | a measure of the bias that exists in a measurement system. |
| Representativeness | the degree to which sample data accurately and precisely represent selected characteristics. |
| Completeness | a measure of the amount of the valid data obtained from the measurement system compared to the amount that was expected under ideal conditions. |
| Comparability | express the confidence with which one data set can be compared with another. |

Acceptable sample precision can be attained by careful sample homogenizing when appropriate. Precision will be calculated as relative percent difference (RPD). The RPD between the values of the duplicates will be calculated as follows:

$$RPD = (D1 - D2) / (D1 + D2) \times 100$$

RPD = Relative Percent Difference

D1 = First Sample Value

D2 = Second Sample Value

Field precision is assessed through the collection and measurement of field duplicates at a rate of 1 duplicate per 10 analytical samples.

The submission of field blanks will provide a check with respect to accuracy. Although accuracy is best assessed by evaluating the results of blanks, blanks do not monitor analyte losses. The submission of blanks will, however, monitor errors associated with sampling process, field contamination, preservation, handling, and laboratory contamination. In the event that the blanks are contaminated and/or poor precision is obtained, the associated data will be qualified as described in Section 12. Through the submission of field QC samples the distinction can be made between laboratory problems, sampling technique, and sample matrix variability. For aqueous matrices, equipment blanks will be collected for every 10, or fewer, number of samples. For volatile organic samples, at least one trip blank will be provided in each cooler containing these samples.

To ensure that samples are representative, all sample collection will be performed in accordance with U.S. EPA-recommended procedures for the collection, preservation, and holding times specified in EPA SW-846. ERM will ensure that the Greiner's Lagoon SAP will be followed and that proper sampling techniques are used.

The data quality objective for the completeness of data with respect to the sampling (field investigation) is 90%. Although this goal appears ambitious, it can be attained. Every effort will be made to obtain valid data for all sampling points.

In order to establish a degree of comparability such that observations and conclusions can be directly compared with all historical data, ERM will use standardized methods of field analysis, sample collection, holding times and preservation. In addition, field conditions will be considered as well as sampling in order to attain a high degree of data comparability. ERM will also ensure that the Greiner's Lagoon SAP is followed and proper sampling techniques are used.

3.3 *LABORATORY QUALITY OBJECTIVES*

Laboratory data quality objectives as specified in EPA SW-846 for precision and accuracy are shown on Tables 2 and 3. Quality control limits are statistically derived for Matrix Spike/Matrix Spike Duplicates (MS/MSD) and Laboratory Control Samples (LCS) from actual sample data using plus or minus three standard deviations from the mean of the population. Because the limits are updated on a periodic basis, they are not included in the laboratory's Standard Operating Procedures (SOPs). The control limits in place at the time of QAPP submittal are provided in Tables 2 and 3. The limits in effect at the time of sample analyses will be used for data validation purposes. Current control charts are available upon request. The laboratory will demonstrate analytical precision and accuracy by the analysis of laboratory duplicates and matrix spike duplicates. Precision will also be demonstrated (as well as instrument stability) by comparison of response factors for calibration standards. Laboratory accuracy will be demonstrated by the addition of surrogate and matrix spike compounds. Accuracy will be presented as percent recovery. Precision will be presented as RPD, RSD, or PD whichever is applicable to the type of QC samples. Laboratory method blanks will also demonstrate accuracy with respect to the analyses. The frequency of laboratory duplicates, matrix spikes and method blanks is specified in Section 9. STL data quality objectives are detailed in their Laboratory

Quality Manual (LQM) dated 2006, which is available at the offices of ERM, Inc. The project contact point for questions about the STL LQM is William Lozier, ERM, Inc.'s Project Manager.

Further, the laboratory will be required to provide all data packages in full QA/QC deliverables as to assure that analytical methods, parameters, and reporting units are compatible with other existing data. The objective for laboratory sample analysis completeness is 95%. Any deviation from this objective must be clearly documented and communicated to the ERM Project Manager.

The laboratory will be expected (as an ideal objective) to report the laboratory detection limits for all samples in the appropriate statistical reporting units for all analyses. The laboratory will follow all method-specific procedures for sample preparation and analysis. However, it should be noted that actual detection limits are sample-specific and depend on variables such as dilution factors, sample matrices and specific analyte. The handling of data reported at or near the detection limit will be done cautiously since the stated data quality objectives for accuracy and precision may not "translate" well in some situations. Laboratory detection limits for all parameters are provided in Table 7.

3.4 DATA MANAGEMENT OBJECTIVE

It is a data management objective that all aspects of the investigation from sample design, collection, shipment analysis use/decision, etc., be performed in conjunction with rigorous QA/QC documentation. The specific details of this documentation can be found throughout this document.

It is expected that by the design of separate data quality requirements for field sampling and laboratory analysis, clear distinctions can be made such that any problems found in the system can be isolated with respect to the cause. Conversely, the data quality requirements are also designated to provide an indication of the variability inherent to the overall system.

Through the use of sampling, analysis, data assessment (data review), data qualification, and feedback the overall data management objective is to provide a complete data base with a high degree of confidence that will thoroughly characterize the media sampled.

4.0 *SAMPLING PROCEDURES*

4.1 *SAMPLING RATIONALE*

Ground water samples will be collected during site monitoring. Sampling locations and analyses have been specifically selected to provide data necessary to meet the objectives of the Site investigation.

4.2 *SAMPLING PROTOCOL SUMMARY*

The Site Sampling and Analysis Plan (SAP) contains detailed descriptions of the objectives and rationale of the sampling program that will be followed during this Site investigation. Specific sampling locations and sampling procedures to be used are also described in the SAP.

4.3 *SAMPLE PACKING, HANDLING AND SHIPMENT*

After a given sample has been collected, a self-adhesive label will be prepared with indelible ink and affixed to each container. At a minimum, the sample label will contain:

- The Investigation Name
- Field Sample Number
- Date and Time Collected
- Sampler's Initials
- Testing Required
- Preservatives Added

An example of a sample container label is provided in Appendix B of the Sampling and Analysis Plan (SAP). Following sample collection, each labeled sample container will be sealed in an individual plastic bag. Samples will then be placed immediately into an insulated cooler with ice or ice packs for shipment to the laboratory.

Chain of custody aspects of sample handling are discussed in detail in Section 4.6. These records are sealed in ziplock bags to protect them

against moisture and will be taped to the lid underside of appropriate sample coolers. Each cooler will contain sufficient ice and/or ice packs to insure that proper temperature is maintained, and will contain appropriate packing material to prevent damage to sample containers.

The sample coolers will be shipped by direct courier or overnight courier according to current U.S. DOT regulations.

4.4 *SAMPLE CONTAINERS, PRESERVATIVES AND HOLDING TIMES*

The specific containers, preservatives and holding times that will be utilized for this investigation are presented on Table 4.

4.5 *PREPARATION OF SAMPLING EQUIPMENT AND CONTAINERS*

4.5.1 *Decontamination of Sampling Equipment*

Procedures for decontaminating drilling and sampling equipment are discussed in the SAP. Decontamination protocols will be strictly adhered to in order to minimize the potential for cross-contamination between sampling locations and contamination of areas off-Site. Detailed personnel decontamination procedures are discussed in the Site specific Health and Safety Plan (HSP), which is included as Appendix C to the O & M Manual.

4.5.2 *Preparation of Sample Containers*

STL will provide appropriately prepared sample containers and coolers for this project. All containers for volatile organics are purchased and precleaned. STL purchases bottles which are tested per the bottle blank program. Preservation using ultra-pure reagents, if necessary, will be provided by STL and added to the containers by the field team.

4.6 *CHAIN OF CUSTODY PROCEDURE*

To establish the documentation necessary to trace sample possession, a chain-of-custody record will be filled out and accompany every sample. An example of a chain-of-custody tracking sheet is included in Appendix B of the Sampling and Analysis Plan. The record will contain the following information:

- Identification of well(s)
- Signature of collector
- Date and time of collection
- Sample type (matrix)
- Container types and volumes
- Preservation method
- Number of containers
- Parameters requested for analysis
- Signature of persons involved in the chain of possession Inclusive dates of possession
- Temperature of sample cooler upon receipt at laboratory.

4.7 DOCUMENTATION OF SAMPLING ACTIVITIES

In order to ensure that all pertinent information and data collected during the Site monitoring are documented completely and correctly, procedures and protocols described in the following sections will be implemented.

4.7.1 *Field Notebooks*

All information pertinent to the field investigation will be recorded in bound and numbered field notebooks. Each team member will be assigned an individual notebook. Field records will, at a minimum, contain the following information:

1. Date
2. Time of each data entry
3. Description of work being performed that day
4. Names and affiliations of all personnel at location
5. Weather conditions on-Site
6. Location and type of activity

7. Sample or boring methods in use
8. Visual observations
9. Pertinent field data (temperature and any other field measurements such as from a FID)
10. Photographs taken, including date, time, direction faced, description of subject or activity, and sequential numbers.

All field notebooks will be standard engineering hardbound books.

4.7.2 *Sample Log Book*

Specific sample information will be compiled into one sample log notebook. The following information will be included in the sample log notebook:

1. Unique sample number
2. Sample date
3. Sampler's initials
4. Sample matrix
5. Number of samples
6. Analyses requested
7. Date shipped to the lab
8. Method of shipment

4.7.3 *Photo-Documentation*

Photographers will record time, date, location, direction faced, sequential number of photograph and roll number, and brief description of the subject in a field notebook.

4.8 *SUMMARY OF SAMPLING AND ANALYSES*

Table 8 provides a summary of the number of environmental samples from each medium that will be collected, what parameters will be analyzed for these samples and the frequency and type of both field and laboratory QC that will be instituted. These procedures are fully described in Section 9 of this QAPP.

5.0 *SAMPLE CUSTODY*

5.1 *FIELD ACTIVITIES - SAMPLING AND MEASURING*

The primary objective of sample custody procedures is to create an accurate written record which can be used to trace the possession and handling of all samples from the moment of their collection, through analysis, until their final disposition. Sample custody for samples collected during this investigation will be maintained by the Site Manager or the field personnel collecting the samples. The Site Manager or field personnel (as designated by the Site Manager) are responsible for documenting each sample transfer and maintaining custody of all samples until they are shipped to the laboratory.

5.1.1 *Chain-of-Custody Procedure*

All necessary sample bottles will be shipped to ERM by STL and received by the Site Manager or field personnel. Therefore, the chain of custody will be initiated by STL with the release of sample bottles. Sample bottles needed for a specific sampling task will then be relinquished by the Site Manager to the sampling team after the Site Manager has verified the integrity of the bottles and assured that the proper bottles have been assigned to the task to be conducted.

As samples are collected and placed in coolers, custody will be maintained by the Site Manager or sampling team until shipment to the laboratory. The specific handling and shipment procedures are described below under Sample Packing, Handling and Shipment.

5.1.2 *Sample Packing, Handling and Shipment*

A self-adhesive sample label, such as that depicted in Appendix B of the Sampling and Analysis Report, will be affixed to each container before sample collection to minimize label loss during handling of the container. Sample labels will contain an abbreviated summary of the logbook entry for each sample. At a minimum, the sample label will contain:

- The investigation name (Greiner's Lagoon Site)
- Sample identification - place of sampling
- Date and time collected

- Sampler's initials
- Testing required
- Preservatives added

Following sample collection, each sample bottle will be sealed in an individual plastic bag. Samples will then be placed immediately into an insulated cooler for shipment to the laboratory. Chain of custody records, completed at the time of sample collection, will accompany the samples inside the cooler for shipment to the laboratory. The chain of custody form provides documentation of handling of each sample from the time it is collected until it is disposed of. Each time the samples are transferred to another custodian, signatures of the persons relinquishing the sample and receiving the sample, as well as the time and date, will document the transfer.

These record forms will be sealed in a Ziplock plastic bag to protect them against moisture. Each cooler will contain sufficient ice and/or ice packs to ensure that proper temperature is maintained, and will be packed in a manner to prevent damage to sample containers. The Site Manager will then initial and place a custody seal (Appendix B of the SAP) on each sample cooler. All coolers will be shipped by direct courier or overnight courier according to current US DOT regulations. Upon receiving the samples, the laboratory Sample Custodian will inspect the condition of the samples, compare the information on the sample labels against the field chain of custody record, assign a STL control number, and log the control number into the computer LIMS sample inventory system.

5.2 **LABORATORY ANALYSIS**

The Laboratory Sample Custodian will note any damaged sample containers or discrepancies between the sample label and information on the field chain-of-custody record when logging the sample and will note any discrepancies in the remarks section of the chain-of-custody form. This information will also be communicated to the Site Manager or field personnel so proper action can be taken. The chain-of-custody form will be signed by both the relinquishing and receiving parties each time the sample changes hands, and the reason for transfer indicated.

When samples requiring preservation by either acid or base (other than volatile samples) are received at the laboratory, the pH will be measured and documented. The pH is adjusted if not correct and documented. The

Laboratory Sample Custodian will then store the sample in a secure sample storage cooler maintained at 4°C (+/-2°C) (where applicable) and maintain custody until the sample is assigned to an analyst for analysis.

An internal chain of custody form will be used by STL to document sample possession from laboratory Sample Custodian to Analysts and final disposition. All chain of custody information will be supplied with the data packages for inclusion in the document control file.

5.3

FINAL EVIDENCE FILE

ERM will require a rigorous data control program that will ensure that all documents for the investigations are accounted for when they are completed. Accountable documents include items such as log books, field data records, correspondence, chain of custody records, analytical reports, data packages, photographs, computer disks, and reports. The Project Manager is responsible for maintaining a central file in a designated secure, limited access area at the ERM, Inc. office. All items added or removed from the file will be signed and dated by the person making the entry.

6.0

CALIBRATION PROCEDURES AND FREQUENCY

A variety of instruments, equipment, and sampling tools will be used to collect and analyze data and samples, and to monitor Site conditions. Proper calibration, maintenance, and use of instruments and equipment is imperative to ensure quality of all data collected. A record of calibration and maintenance activities is as important as the data record itself. The responsibility for proper equipment calibration and maintenance lies with the Site Manager and the Laboratory Coordinator.

General calibration requirements are presented below.

- All adjustable, mechanical, electronic, and/or recording instruments will be calibrated prior to entry into the field.
- Measuring devices such as steel tapes will be calibrated at the start of the program to check for kinks, stretching, or worn markings and will be under constant field observation for evidence of these defects.
- Instruments that require frequent calibration checks or calibration during use (e.g., pH meters) will be calibrated as specified in their operating procedures.

Records of calibration, which will be kept in the field notebook, will include the following information:

- Date of calibration
- Next due date for calibration
- Initials of person performing calibration
- Adjustments made and the accuracy of the equipment prior to and following calibration
- Record of equipment failure or inability to meet specifications.

6.1

FIELD INSTRUMENTS

To ensure that measurements during the investigation have been collected with properly calibrated instruments, field personnel will follow the procedures described in the Equipment Owners Manual for each of the field instruments. Section 4.3.6 of the SAP June 2005 provides a

description of the field equipment and calibration. The frequency of field calibration procedures will, at a minimum, include the following:

- The pH and specific conductance meters will be calibrated a minimum of once daily and documented in the calibrator's field book. Calibration will be checked as necessary to ensure proper measurements are taken.
- pH meters will be calibrated using specific techniques according to the manufacturer's instructions and two standard buffer solutions (either pH 4 and 7, or 7 and 10) obtained from chemical supply houses. The pH value of these standard buffers will be compensated for temperature according to the values supplied on the manufacturer's bottle label. The temperature (measured as below) at which the sample pH was measured will then be used to compensate for temperature on the meter.
- Temperature measurements will be performed using a field thermometer and recorded to ± 0.2 degrees Celsius.
- Specific conductance meters will be calibrated using a 1413.0 umhos KCl solution prepared by ERM according to Standard Methods for the Analysis of Water and Wastewater, 16th Edition, 1985. Method 205, 3b, page 79. The conductivity probe cell constant will be calculated according to the formula:

$$0 \quad K = \frac{1413.0(1/C)}{+0.02(T - 25^{\circ}\text{C})}$$

- 1 Where: K = probe cell constant (unitless)
 C = measured conductance value of standard
 T = temperature ($^{\circ}\text{C}$) of standard

Table 5 will be used to correct for the standard solution's conductivity value if it is not at 25°C .

Using the cell constant calculated above and the following formula, field specific conductance measurements will be corrected to 25°C .

$$0 \quad S = \frac{K \cdot C}{[1 + 0.02(T - 25^{\circ}\text{C})]}$$

- 1 Where: S = Specific conductance at 25°C (umhos/cm)
 K = calculated cell constant
 C = field specific conductance (umhos/cm)
 T = temperature ($^{\circ}\text{C}$) of sample at which conductance was measured

Despite even the most rigorous maintenance program, equipment failures do occur. When equipment cannot be repaired, it will be returned to the manufacturer for repairs. Similar equipment will be brought to the site to enable the investigation to continue.

6.2 *LABORATORY INSTRUMENTS*

Laboratory instrument calibration and frequency for the required methods specified for this study are as specified in the EPA SW-846 and STL's SOPs for organics and inorganics and are discussed in STL's LQM.

7.0 ANALYTICAL PROCEDURES

SOPS prepared by STL, North Canton, Ohio for the Greiner's Lagoon Site are listed in Table 6.

7.1 SAMPLE PREPARATIONS

The specifics for laboratory sample preparation are detailed in EPA SW-846 and SOPs. These procedures will be followed by STL during the analysis of samples collected at the Site.

7.2 INSTRUMENT START-UP AND PERFORMANCE CHECK

Details concerning instrument start-up and performance checks are specified in EPA SW-846 and SOPs. These procedures will be followed by STL during the analysis of samples collected at the Site.

7.3 DETECTION LIMITS FOR PARAMETERS TO BE TESTED

A complete list of the organic and inorganic compounds/constituents and the applicable detection limits that will be required for all samples collected for the subject investigation are presented in Table 7.

7.4 INITIAL CALIBRATION AND CONTINUING CALIBRATION CHECK

Details concerning initial and continuing calibrations for laboratory instrumentation are specified in STL's SOPs and LQM.

7.5 ANALYTICAL PROCEDURES FOR EACH SAMPLE MATRIX AND/OR PARAMETERS

The analytical methods to be used for the analysis of the sample media collected at the Site will be in accordance with approved EPA SW-846 procedures.

7.6 CHAIN-OF-CUSTODY PROCEDURE

The laboratory chain of custody procedures are discussed in detail in the STL LQM. This document is available for review as necessary.

Data validation procedures will be followed to ensure that raw data are not altered and that an audit trail is developed for those data which require reduction. All the field data, such as those generated during field measurements, observations and field instrument calibrations, will be entered directly into a bound field notebook. A project team member(s), as designated by the Site Manager, will be responsible for proofing data transfers made, at the end of each day, and ERM's Quality Assurance Officer will proof at least 10 percent of all data transfers.

STL group leaders will check and validate all data generated within their laboratory as specified in the STL LQM. Also, the STL Quality Assurance Department is responsible for monitoring all laboratory QC activities and for verifying that all systems are in control. Finally, all data is reviewed by the Final Technical Reviewer before the data is released to ERM.

Upon receipt of the sample data packages, the laboratory data will again be quantitatively and qualitatively validated by ERM's Quality Assurance Manager. Data validation is discussed in detail in Section 12 of this QAPP.

Laboratory data for solids analyses will be reported as ug/kg (organics) and mg/kg (inorganics) on a dry weight basis. Data packages associated with the analyses of samples collected during the investigation will be prepared utilizing the following QA/QC deliverables.

- 0 Case Narrative
 - 1 Sample Summary
 - 2 Method Reference
 - 3 GC/MS Volatile
 - 4 QC Summary Data
 - 5 Sample Data
 - 6 Standard Data
 - 7 Raw QC Data
 - 8 GC/MS Semivolatile
 - 9 QC Summary Data
 - 10 Sample Data

- 11 Standard Data
- 12 Raw QC Data
- 13 Inorganic
 - 14 QC Summary Data
 - 15 Sample Data
 - 16 Calibration Data
 - 17 Instrument Printouts
 - 18 Prep Logs
- 19 Organic Instrument Log Sheets
- 20 Organic Extraction Log Sheets
- 21 Internal Chain-of-Custody
- 22 Chain-of-Custody

9.0 INTERNAL QUALITY CONTROL CHECKS

9.1 LABORATORY INTERNAL QUALITY CONTROL CHECKS

STL's Internal Quality Control checks are specified in EPA SW-846 and SOPs and are briefly discussed in the STL's LQM. These checks will be a continuation of ERM's Field Internal Quality Control Checks presented below.

9.2 FIELD INTERNAL QUALITY CONTROL CHECKS

Field Internal Quality Control Checks will be applied during this investigation as follows:

9.2.1 Trip Blanks

Trip blanks are purchased pre-prepared by the laboratory. These samples are transported from the laboratory to the field along with the empty sample containers and returned to the laboratory with the collected samples. In this way, trip blanks are used to determine if cross-contamination has occurred during sample collection or while in transport to the field or to the laboratory. At least one trip blank will accompany each cooler which contains samples collected for volatile organic analysis.

9.2.2 Equipment Rinseate Blanks

These blanks consist of pure, deionized water that will be poured through the clean sampling equipment and poured into containers with any preservatives required for that analysis. Equipment blanks are used to measure the cleanliness of decontaminated sampling equipment when used at several locations. For aqueous matrices equipment/rinseate blanks will be collected for every 10, or fewer, number of samples and will be analyzed for the same parameters as the samples.

9.2.3 Duplicate Samples

Duplicate samples will be collected to allow determination of analytical precision. One for every 10 samples for each media will be collected and

submitted for analysis. These samples may be run as matrix spike[®] duplicates (see below).

9.3 *LABORATORY INTERNAL QUALITY CONTROL CHECKS*

9.3.1 *Matrix Spike Sample*

A matrix spike sample will also be submitted as a further QC check. These will be collected at the same frequency as stated above for the duplicate samples. These will allow accuracy to be determined by the recovery rates of compounds (the matrix spike and/or surrogate spike compounds defined in the analytical methods). The purpose of these laboratory spikes is to monitor any possible matrix effects specific to samples collected from the subject Site. The addition of known concentrations of compounds/constituents into the sample also monitors extraction/digestion efficiency.

Summarizing the above discussion, every tenth sample or ten percent of the total number of samples, whichever is more frequent, will be analyzed in duplicate (or matrix spike duplicate) and run as a matrix spike sample.

10.0 PERFORMANCE AND SYSTEM AUDITS

10.1 ON-SITE AUDIT

An on-Site system audit will be performed during major field activities to review field-related quality assurance activities. The system audit will be conducted by ERM's Project Manager or a designated alternate.

Specific elements of the on-Site audit include the verification of:

- Completeness and accuracy of sample Chain-of-Custody forms, including documentation of times, dates, transaction descriptions, and signatures.
- Completeness and accuracy of sample identification labels; including notation of time, date, location, type of sample, person collecting sample, preservation method used, and type of testing required.
- Completeness and accuracy of field notebooks, including documentation of times, dates, sampling method used, sampling locations, number of samples taken, name of person collecting samples, and types of samples.
- Adherence to health and safety guidelines outlined in the HSP including wearing of proper protective clothing.
- Adherence to decontamination procedures outlined in the SAP, including proper decontamination of sampling equipment.
- Adherence to sample collection, preparation, preservation, and storage procedures.

10.2 INTERNAL AUDIT

10.2.1 Internal Laboratory Audits

STL performs regular systems and performance audits. On an annual basis, the Quality Assurance Manager audits the laboratory facilities. The audits include logbook review, chromatogram review, equipment inspection, and compliance with Laboratory Quality Control SOPs. Audit reports are submitted to the Corporate QA Manager/Director, Operations Director, Laboratory Manager, and Group Coordinators. The Group

Coordinators are required to respond in writing to the QA Manager with the corrective actions taken. Depending on the nature of the problems found, follow-up audits are conducted to determine that corrective actions were taken sufficient and appropriate.

10.2.2 *External Performance Audit of STL*

In addition to the above program, the laboratory participates in a number of federal, state, and private Laboratory Certification, Audit and/or Approval Programs in order to demonstrate its analytical capabilities and expertise. Participation in these programs requires the Laboratory to demonstrate acceptable laboratory performance through satisfactory completion of routine systems and/or performance audits. As a part of its certification by these various federal, state, and private agencies, STL submits to on-Site external systems audits. The inspection audits evaluate the adequacy of laboratory personnel, equipment, documentation, and QA/QC. Performance audits require satisfactory blind analysis of unknown intralaboratory performance evaluation samples. A listing of laboratory certifications, audits, and approvals is available upon request.

11.0 PREVENTIVE MAINTENANCE

11.1 LABORATORY MAINTENANCE

A typical standard operating procedure for maintenance, including specific routine and preventive procedures, and maintenance logs for the laboratory instrumentation are given in the STL QAPP.

11.2 FIELD MAINTENANCE

ERM's field equipment is maintained through the use of a tracking system incorporating the tagging of each equipment item. This tag identifies its most recent maintenance and condition. When equipment that is in need of repair is returned to the equipment warehouse, it is appropriately flagged for the required maintenance to be performed. This process ensures that only operable and maintained equipment enters the field. Routine daily maintenance procedures conducted in the field will include:

- Removal of surface dirt and debris from exposed surfaces of the sampling equipment.
- Storage of equipment away from the elements.
- Daily inspections of sampling equipment for possible problems.

Spare and replacement parts stored in the field to minimize downtime include:

- Extra sample containers
- Spare parts
- Spare bucket auger
- Additional supply of health and safety equipment i.e., boots, gloves, tyvek, etc.
- Additional equipment as necessary for the field tasks.

12.0 *SPECIFIC ROUTINE PROCEDURES USED TO ASSESS DATA PRECISION, ACCURACY, AND COMPLETENESS*

12.1 *OVERALL PROJECT ASSESSMENT*

Overall data quality will be assessed by a thorough understanding of the data quality objectives which are stated within this QAPP. By maintaining thorough documentation of all decisions made during each phase of sampling, performing field and laboratory audits, thoroughly reviewing (validating) the analytical data as it is generated by the laboratory, and providing appropriate feedback as problems arise in the field or at the laboratory, ERM will closely monitor data accuracy, precision and completeness.

12.2 *FIELD QUALITY ASSESSMENT*

To assure that all field data are collected accurately and correctly, specific instructions will be issued to all personnel involved in field data acquisition by the Project Manager. The quality assurance officer will perform field audit(s) during the investigation to document that the appropriate procedures are being followed with respect to sample (and blank) collection. These audits will include a thorough review of the field books used by the project personnel to insure that all tasks were performed as specified in the instructions. The field audits will necessarily enable the data quality to be assessed with regard to the field operations.

The evaluation (data review) of field blanks, and other field QC samples will provide definitive indications of the data quality.

12.3 *LABORATORY DATA QUALITY ASSESSMENT*

Specific measures that will be taken by STL to assess data quality as specified in EPA SW-846 are presented in the STL LQM.

12.4

ERM'S LABORATORY DATA ASSESSMENT

All analytical data generated during the investigation will undergo a rigorous ERM data review. This review will be performed in accordance with EPA SW-846 and the SOPs. The USEPA "Functional Guidelines for the Evaluation of Organic (and Inorganic) Analysis" will be used as a model for data review.

A preliminary review will be performed to verify all necessary paperwork and deliverables are present.

A detailed quality assurance review will be performed by the ERM Quality Assurance Manager (or a staff reviewer) to verify the qualitative and quantitative reliability of the data as it is presented. This review will include a detailed review and interpretation of all data generated by STL. The primary tools which will be used by experienced data review chemists will be guidance documents, and professional judgment.

Based upon the review of the analytical data, an organic and inorganic quality assurance report will be prepared which will state in a technical yet "user friendly" fashion the qualitative and quantitative reliability of the analytical data. The report will consist of a general introduction section, followed by qualifying statements that should be taken into consideration for the analytical results to best be utilized. Based upon the quality assurance review, qualifier codes will be placed next to specific sample results on the sample data table. These qualifier codes will serve as an indication of the qualitative and quantitative reliability.

Before the data review, an organic and inorganic support documentation package will be prepared by STL which will provide the backup information that will accompany all qualifying statements presented in the quality assurance review.

Once the review has been completed, the Quality Assurance Manager will then submit these data to the Project Manager. These approved data tables and quality assurance reviews will be signed and dated by the Quality Assurance Manager.

12.5

DATA MANAGEMENT QUALITY ASSESSMENT

Analytical data generated from the subject investigation will be validated, qualified and submitted to the Project Manager. Information submitted to

the Project Manager will include a comparison of results obtained from samples taken within the same general vicinity, and the identification of missing data points. By examination of the data at the "back-end" of the process, the data quality can be assessed with respect to representativeness, precision, compatibility and completeness.

13.0 *CORRECTIVE ACTION*

13.1 *STL'S CORRECTIVE ACTION*

Corrective actions for STL are presented in the STL QAPP. STL will provide documentation as to what, if any, corrective actions were initiated concerning this study and report them to ERM's Quality Assurance Manager. Examples of problems and the required corrective action include: instrument out of control, recalibrate; poor surrogate recoveries, re-extract; poor internal standard areas, re-analyze.

13.2 *ERM'S CORRECTIVE ACTION*

Field quality assurance activities will be reported to ERM's Project Manager. Problems encountered during the study affecting quality assurance and the corrective action taken will be reported on the sampling field form presented in Appendix B of the Sampling and Analysis Plan.

The Project Manager will be responsible for initiating the corrective actions and for insuring that the actions are taken in a timely manner, and that the desired results are produced.

The Project Manager will report to the Quality Assurance Manager and Quality Assurance Officer on all necessary corrective actions taken, the outcome of these actions, and their effect on data produced.

Upon project completion the Project Manager, in conjunction with the Quality Assurance Manager and Officer will prepare a summary of all applicable quality assurance activities for inclusion in the Annual Report. This summary shall contain at least the following types of information:

- The status and coverage of various laboratory and field quality assurance project activities.
- Data quality assurance review including assessment of: accuracy, precision, completeness, representativeness, and comparability.
- Significant quality assurance problems discovered, corrective actions taken, progress and improvements.
- Any significant field observations noted in the field notebook during the sampling procedure.
- A summarization of the results of performance and system audits.

Tables

Table 1 can be found in the main text – Section 3.2

Table 2 Data Quality Objectives for Precision and Accuracy Matrix Spike and Laboratory Control Sample Recovery Limits

| Parameter | Laboratory Control Sample | | Matrix Spike Sample | |
|--------------------------------|---------------------------|-----|---------------------|-----|
| | Accuracy (%R) | RPD | Accuracy (%R) | RPD |
| VOC | | | | |
| Acetone | 22-200 | 95 | 45-128 | 30 |
| Acetonitrile | 0-0 | 0 | 0-0 | 0 |
| Acrolein | 0-0 | 0 | 0-0 | 0 |
| Acrylonitrile | 0-0 | 0 | 0-0 | 0 |
| Benzene | 80-116 | 20 | 78-118 | 20 |
| Bromodichloromethane | 87-130 | 30 | 80-146 | 30 |
| Bromoform | 76-150 | 30 | 58-176 | 30 |
| Bromomethane | 64-129 | 30 | 55-145 | 30 |
| 2-Butanone (MEK) | 0-0 | 0 | 0-0 | 0 |
| Carbon disulfide | 73-139 | 30 | 69-138 | 41 |
| Carbon tetrachloride | 75-149 | 30 | 63-176 | 30 |
| Chlorobenzene | 76-177 | 20 | 76-117 | 20 |
| Chloroprene | 0-0 | 0 | 0-0 | 0 |
| Dibromochloromethane | 81-138 | 30 | 71-158 | 30 |
| Chloroethane | 66-126 | 30 | 59-142 | 30 |
| Chloroform | 84-128 | 30 | 83-141 | 30 |
| Chloromethane | 48-123 | 30 | 40-137 | 39 |
| Allyl chloride | 0-0 | 0 | 0-0 | 0 |
| 1,2-Dibromo-3-chloropropane | 70-130 | 30 | 70-130 | 30 |
| 1,2-Dibromoethane (EDB) | 0-0 | 0 | 0-0 | 0 |
| Dibromomethane | 0-0 | 0 | 0-0 | 0 |
| trans-1,4-Dichloro-2-butene | 0-0 | 0 | 0-0 | 0 |
| Dichlorodifluoromethane | 70-130 | 30 | 70-130 | 30 |
| 1,1-Dichloroethane | 86-123 | 30 | 88-127 | 30 |
| 1,2-Dichloroethane | 79-136 | 30 | 71-160 | 30 |
| trans-1,2-Dichloroethene | 80-120 | 30 | 85-116 | 30 |
| 1,1-Dichloroethene | 63-130 | 20 | 62-130 | 20 |
| 1,2-Dichloropropane | 82-115 | 30 | 87-114 | 30 |
| cis-1,3-Dichloropropene | 84-130 | 30 | 82-130 | 30 |
| trans-1,3-Dichloropropene | 84-130 | 30 | 73-147 | 30 |
| 1,4-Dioxane | 0-0 | 0 | 0-0 | 0 |
| Ethylbenzene | 86-116 | 30 | 86-132 | 30 |
| Ethyl methacrylate | 0-0 | 0 | 0-0 | 0 |
| 2-Hexanone | 35-200 | 52 | 81-128 | 30 |
| Iodomethane | 0-0 | 0 | 0-0 | 0 |
| Isobutyl alcohol | 0-0 | 0 | 0-0 | 0 |
| Methacrylonitrile | 0-0 | 0 | 0-0 | 0 |
| Methylene chloride | 78-118 | 30 | 82-155 | 30 |
| Methyl methacrylate | 0-0 | 0 | 0-0 | 0 |
| 4-Methyl-2-pentanone (MIBK) | 0-0 | 0 | 0-0 | 0 |
| Propionitrile | 0-0 | 0 | 0-0 | 0 |
| Styrene | 85-117 | 30 | 83-120 | 30 |
| 1,1,1,2-Tetrachloroethane | 0-0 | 0 | 0-0 | 0 |
| 1,1,2,2-Tetrachloroethane | 85-118 | 30 | 88-116 | 30 |
| Tetrachloroethene | 88-113 | 30 | 85-121 | 30 |
| Toluene | 74-119 | 20 | 70-119 | 20 |
| 1,1,1-Trichloroethane | 78-140 | 30 | 71-162 | 30 |
| 1,1,2-Trichloroethane | 83-122 | 30 | 86-129 | 30 |
| Trichloroethene | 75-122 | 20 | 62-130 | 20 |
| Trichlorofluoromethane | 70-130 | 30 | 70-130 | 30 |
| 1,2,3-Trichloropropane | 0-0 | 0 | 0-0 | 0 |
| Vinyl acetate | 0-0 | 0 | 0-0 | 0 |
| Vinyl chloride | 61-120 | 30 | 88-126 | 30 |
| Xylenes (total) | 87-116 | 30 | 89-121 | 30 |
| 4-Bromofluorobenzene | 74-116 | 0 | 74-116 | 0 |
| 1,2-Dichloroethane-d4 | 61-128 | 0 | 61-128 | 0 |
| Toluene-d8 | 76-110 | 0 | 76-110 | 0 |
| Dibromofluoromethane | 73-122 | 0 | 73-122 | 0 |
| SVOCs | | | | |
| a,a-Dimethylphenethylamine | 0-0 | 0 | 0-0 | 0 |
| Acenaphthene | 40-110 | 30 | 36-110 | 30 |
| Acenaphthylene | 43-110 | 30 | 39-110 | 30 |
| Acetophenone | 0-0 | 0 | 0-0 | 0 |
| 2-Acetylaminofluorene | 0-0 | 0 | 0-0 | 0 |
| 4-Aminobiphenyl | 0-0 | 0 | 0-0 | 0 |
| Aniline | 0-0 | 0 | 0-0 | 0 |
| Anthracene | 54-114 | 30 | 46-110 | 30 |
| Aramite | 0-0 | 0 | 0-0 | 0 |
| Benzo(a)anthracene | 55-115 | 30 | 52-110 | 30 |
| Benzo(b)fluoranthene | 43-122 | 30 | 33-114 | 30 |
| Benzo(k)fluoranthene | 43-124 | 30 | 32-121 | 30 |
| Benzo(ghi)perylene | 45-120 | 30 | 34-116 | 30 |
| Benzo(a)pyrene | 43-116 | 30 | 33-110 | 30 |
| Benzyl alcohol | 0-0 | 0 | 0-0 | 0 |
| bis(2-Chloroethoxy)methane | 39-110 | 30 | 35-110 | 30 |
| bis(2-Chloroethyl) ether | 34-113 | 30 | 27-110 | 30 |
| bis(2-Chloro-1-methylethyl) et | 0-0 | 0 | 0-0 | 0 |
| bis(2-Ethylhexyl) phthalate | 36-163 | 30 | 40-140 | 30 |
| 4-Bromophenyl phenyl ether | 51-114 | 30 | 42-113 | 30 |
| Butyl benzyl phthalate | 53-126 | 30 | 51-121 | 30 |
| 4-Chloroaniline | 10-110 | 30 | 10-110 | 30 |
| Chlorobenzilate | 0-0 | 0 | 0-0 | 0 |

Table 2 Data Quality Objectives for Precision and Accuracy Matrix Spike and Laboratory Control Sample Recovery Limits

| Parameter | Laboratory Control Sample | | Matrix Spike Sample | |
|--------------------------------|---------------------------|-----|---------------------|-----|
| | Accuracy (%R) | RPD | Accuracy (%R) | RPD |
| 4-Chloro-3-methylphenol | 39-110 | 30 | 33-110 | 30 |
| 2-Chloronaphthalene | 39-110 | 30 | 34-110 | 30 |
| 2-Chlorophenol | 27-110 | 30 | 26-110 | 30 |
| 4-Chlorophenyl phenyl ether | 50-115 | 30 | 43-113 | 30 |
| Chrysene | 55-115 | 30 | 52-111 | 30 |
| Diallate | 0-0 | 0 | 0-0 | 0 |
| Dibenz(a,h)anthracene | 16-122 | 30 | 35-118 | 30 |
| Dibenzofuran | 16-111 | 30 | 41-110 | 30 |
| Di-n-butyl phthalate | 55-122 | 30 | 50-117 | 30 |
| 1,2-Dichlorobenzene | 23-110 | 30 | 22-110 | 30 |
| 1,3-Dichlorobenzene | 19-110 | 30 | 19-110 | 30 |
| 1,4-Dichlorobenzene | 19-110 | 30 | 17-110 | 30 |
| 3,3'-Dichlorobenzidine | 19-110 | 30 | 10-110 | 30 |
| 2,4-Dichlorophenol | 33-110 | 30 | 30-110 | 30 |
| 2,6-Dichlorophenol | 0-0 | 0 | 0-0 | 0 |
| Diethyl phthalate | 33-134 | 30 | 33-130 | 30 |
| Dimethoate | 0-0 | 0 | 0-0 | 0 |
| p-Dimethylaminoazobenzene | 0-0 | 0 | 0-0 | 0 |
| 7,12-Dimethylbenz(a)anthracene | 0-0 | 0 | 0-0 | 0 |
| 3,3'-Dimethylbenzidine | 0-0 | 0 | 0-0 | 0 |
| 2,4-Dimethylphenol | 12-110 | 30 | 11-110 | 30 |
| Dimethyl phthalate | 15-143 | 30 | 36-124 | 30 |
| 1,3-Dinitrobenzene | 0-0 | 0 | 0-0 | 0 |
| 4,6-Dinitro-2-methylphenol | 28-112 | 30 | 25-110 | 30 |
| 2,4-Dinitrophenol | 17-112 | 30 | 11-119 | 30 |
| 2,4-Dinitrotoluene | 52-123 | 30 | 46-119 | 30 |
| 2,6-Dinitrotoluene | 52-119 | 30 | 48-115 | 30 |
| 2-sec-Butyl-4,6-dinitrophenol | 0-0 | 0 | 0-0 | 0 |
| Di-n-octyl phthalate | 44-128 | 30 | 36-124 | 30 |
| Diphenylamine | 0-0 | 0 | 0-0 | 0 |
| Disulfoton | 0-0 | 0 | 0-0 | 0 |
| Ethyl methanesulfonate | 0-0 | 0 | 0-0 | 0 |
| Famphur | 0-0 | 0 | 0-0 | 0 |
| Fluoranthene | 54-122 | 30 | 53-11 | 30 |
| Fluorene | 47-112 | 30 | 43-110 | 30 |
| Hexachlorobenzene | 51-112 | 30 | 40-113 | 30 |
| Hexachlorobutadiene | 13-110 | 30 | 14-110 | 30 |
| Hexachlorocyclopentadiene | 10-110 | 30 | 10-110 | 30 |
| Hexachloroethane | 12-110 | 30 | 10-110 | 30 |
| Hexachloropropene | 0-0 | 0 | 0-0 | 0 |
| Indeno(1,2,3-cd)pyrene | 46-121 | 30 | 36-116 | 30 |
| Isophorone | 44-128 | 30 | 34-125 | 30 |
| Isosafrole | 0-0 | 0 | 0-0 | 0 |
| Methapyrilene | 0-0 | 0 | 0-0 | 0 |
| 3-Methylcholanthrene | 0-0 | 0 | 0-0 | 0 |
| Methyl methanesulfonate | 0-0 | 0 | 0-0 | 0 |
| 2-Methylnaphthalene | 35-110 | 30 | 35-110 | 30 |
| 2-Methylphenol | 30-110 | 30 | 26-110 | 30 |
| 3-Methylphenol | 0-0 | 0 | 0-0 | 0 |
| 4-Methylphenol | 32-110 | 30 | 25-110 | 30 |
| Naphthalene | 31-110 | 30 | 32-110 | 30 |
| 1,4-Naphthoquinone | 0-0 | 0 | 0-0 | 0 |
| 1-Naphthylamine | 0-0 | 0 | 0-0 | 0 |
| 2-Naphthylamine | 0-0 | 0 | 0-0 | 0 |
| 2-Nitroaniline | 43-130 | 30 | 31-129 | 30 |
| 3-Nitroaniline | 45-116 | 30 | 23-112 | 30 |
| 4-Nitroaniline | 45-120 | 30 | 26-115 | 30 |
| Nitrobenzene | 37-115 | 30 | 26-118 | 30 |
| 2-Nitrophenol | 29-110 | 30 | 30-110 | 30 |
| 4-Nitrophenol | 12-130 | 30 | 13-127 | 30 |
| 4-Nitroquinoline-1-oxide | 0-0 | 0 | 0-0 | 0 |
| N-Nitrosodi-n-butylamine | 0-0 | 0 | 0-0 | 0 |
| N-Nitrosodiethylamine | 0-0 | 0 | 0-0 | 0 |
| N-Nitrosodimethylamine | 0-0 | 0 | 0-0 | 0 |
| N-Nitrosodiphenylamine | 53-113 | 30 | 28-118 | 30 |
| N-Nitrosodi-n-propylamine | 37-121 | 30 | 25-119 | 30 |
| N-Nitrosomethylethylamine | 0-0 | 0 | 0-0 | 0 |
| N-Nitrosomorpholine | 0-0 | 0 | 0-0 | 0 |
| N-Nitrosopiperidine | 0-0 | 0 | 0-0 | 0 |
| N-Nitrosopyrrolidine | 0-0 | 0 | 0-0 | 0 |
| 5-Nitro-o-toluidine | 0-0 | 0 | 0-0 | 0 |
| Pentachlorobenzene | 0-0 | 0 | 0-0 | 0 |
| Pentachloroethane | 0-0 | 0 | 0-0 | 0 |
| Pentachloronitrobenzene | 0-0 | 0 | 0-0 | 0 |
| Pentachlorophenol | 26-110 | 30 | 23-110 | 30 |
| Phenacetin | 0-0 | 0 | 0-0 | 0 |
| Phenanthrene | 52-114 | 30 | 47-110 | 30 |
| Phenol | 14-112 | 30 | 16-110 | 30 |
| p-Phenylene diamine | 0-0 | 0 | 0-0 | 0 |
| Phorate | 0-0 | 0 | 0-0 | 0 |
| 2-Picoline | 0-0 | 0 | 0-0 | 0 |
| Pronamide | 0-0 | 0 | 0-0 | 0 |
| Pyrene | 55-120 | 30 | 54-115 | 30 |

Table 2 Data Quality Objectives for Precision and Accuracy Matrix Spike and Laboratory Control Sample Recovery Limits

| Parameter | Laboratory Control Sample | | Matrix Spike Sample | |
|-------------------------------|---------------------------|-----|---------------------|-----|
| | Accuracy (%R) | RPD | Accuracy (%R) | RPD |
| Pyridine | 10-110 | 30 | 10-110 | 30 |
| Safrole | 0-0 | 0 | 0-0 | 0 |
| 1,2,4,5-Tetrachlorobenzene | 0-0 | 0 | 0-0 | 0 |
| 2,3,4,6-Tetrachlorophenol | 0-0 | 0 | 0-0 | 0 |
| Tetraethyldithiopyrophosphate | 0-0 | 0 | 0-0 | 0 |
| Thionazin | 0-0 | 0 | 0-0 | 0 |
| o-Toluidine | 0-0 | 0 | 0-0 | 0 |
| 1,2,4-Trichlorobenzene | 25-110 | 30 | 25-110 | 30 |
| 2,4,5-Trichlorophenol | 39-110 | 30 | 36-110 | 30 |
| 2,4,6-Trichlorophenol | 35-110 | 30 | 34-110 | 30 |
| O,O,O-Triethyl phosphorothio | 0-0 | 0 | 0-0 | 0 |
| 1,3,5-Trinitrobenzene | 0-0 | 0 | 0-0 | 0 |
| 2-Fluorobiphenyl | 28-110 | 0 | 28-110 | 0 |
| 2-Fluorophenol | 10-110 | 0 | 10-110 | 0 |
| 2,4,6-Tribromophenol | 22-120 | 0 | 22-120 | 0 |
| Nitrobenzene-d5 | 27-111 | 0 | 27-111 | 0 |
| Phenol-d5 | 10-110 | 0 | 10-110 | 0 |
| Terphenyl-d14 | 37-119 | 0 | 37-119 | 0 |
| Metals | | | | |
| Arsenic | 80-120 | 20 | 75-125 | 20 |
| Lead | 80-120 | 20 | 75-125 | 20 |
| Selenium | 80-120 | 20 | 75-125 | 20 |
| Thallium | 80-120 | 20 | 75-125 | 20 |
| Aluminum | 80-120 | 20 | 75-125 | 20 |
| Antimony | 80-120 | 20 | 75-125 | 20 |
| Arsenic | 80-120 | 20 | 75-125 | 20 |
| Barium | 80-120 | 20 | 75-125 | 20 |
| Beryllium | 80-120 | 20 | 75-125 | 20 |
| Boron | 80-120 | 20 | 75-125 | 20 |
| Cadmium | 80-120 | 20 | 75-125 | 20 |
| Calcium | 80-120 | 20 | 75-125 | 20 |
| Chromium | 80-120 | 20 | 75-125 | 20 |
| Cobalt | 80-120 | 20 | 75-125 | 20 |
| Copper | 80-120 | 20 | 75-125 | 20 |
| Iron | 77-127 | 20 | 75-125 | 20 |
| Lead | 80-120 | 20 | 75-125 | 20 |
| Magnesium | 80-120 | 20 | 75-125 | 20 |
| Manganese | 80-120 | 20 | 75-125 | 20 |
| Molybdenum | 80-120 | 20 | 75-125 | 20 |
| Nickel | 80-120 | 20 | 75-125 | 20 |
| Potassium | 80-120 | 20 | 75-125 | 20 |
| Selenium | 80-120 | 20 | 75-125 | 20 |
| Silver | 80-120 | 20 | 75-125 | 20 |
| Sodium | 80-120 | 20 | 75-125 | 20 |
| Thallium | 80-120 | 20 | 75-125 | 20 |
| Tin | 80-120 | 20 | 75-125 | 20 |
| Titanium | 80-120 | 20 | 75-125 | 20 |
| Vanadium | 80-120 | 20 | 75-125 | 20 |
| Zinc | 80-120 | 20 | 75-125 | 20 |
| Mercury | 82-131 | 20 | 68-149 | 20 |

Table 3 ***Surrogate Spike Control Limits for Accuracy Objectives⁽¹⁾***

| Surrogate | Surrogate Spike Control Limits |
|--|--------------------------------|
| | Liquid (%) |
| Volatile Organic Surrogates | |
| 4-Bromofluorobenzene | 76-114 |
| 1,2-Dichloroethane-d4 | 61-116 |
| Toluene-d8 | 76-110 |
| Dibromofluoromethane | 73-122 |
| Semivolatile Organic Surrogates | |
| 2-Fluorobiphenyl | 28-110 |
| 2-Fluorophenol | 10-110 |
| 2,4,6-Tribromophenol | 22-120 |
| Nitrobenzene-d5 | 27-111 |
| Phenol-d5 | 10-110 |
| Terphenyl-d14 | 37-119 |

(1) Values represent the minimum obtainable range.

Table 4 ***Requirements for Containers, Preservation Holding Times, and Sample Volumes***

| Parameters (1) | Containers (2) | Preservation | Holding Time ⁽³⁾ | Volume |
|----------------|----------------|---|---|-------------------------------------|
| Metals | P, G | HNO ₃ to pH ≤ 2 | 6 months, 28 days (Hg only) | 100 mL |
| Volatiles | 40 mL vial | 4°C (+/-2°C)* HCl or H ₂ SO ₄ to pH ≤ 2 | 14 days 7 days (no preserv.) | (3) 40 mL vial - no headspace |
| Semivolatiles | G, 1L amber | 4°C (+/- 2°C)* | 7 days until extraction 40 days until analysis | (2) 1L |

1. See Table 6 in QAPP for specific laboratory analysis methods

2. (P) Polyethylene (G) Glass

3. From Time of Sample Collection

Source: EPA SW-846, Third Edition

* If residual chlorine present, add 3mL sodium thiosulfate

** If residual chlorine present, add 3mL 10% sodium thiosulfate

Table 5 **Conductivity Temperature Corrections for 1,413 umhos/cm
Conductivity Standard**

| Temperature, °C | umhos/cm |
|-----------------|----------|
| 15 | 1,141.5 |
| 16 | 1,167.5 |
| 17 | 1,193.5 |
| 18 | 1,219.9 |
| 19 | 1,246.4 |
| 20 | 1,273.0 |
| 21 | 1,299.7 |
| 22 | 1,326.6 |
| 23 | 1,353.6 |
| 24 | 1,380.8 |
| 25 | 1,408.1 |
| 26 | 1,436.5 |
| 27 | 1,463.2 |
| 28 | 1,490.9 |
| 29 | 1,518.7 |
| 30 | 1,546.7 |

Table 6 Standard Operating Procedures

| Parameter | Matrix | Method | SOP# | SOP Description |
|-------------------|--------|-------------|----------------|------------------------|
| MS Volatiles | Water | 8260B | CORP-MS-0002NC | GC/MS Volatiles |
| MS Semi-Volatiles | Water | 8270c | Corpms0001NC | GCMS Semivolatiles |
| Metals - ICP | Water | 6010B | CPMT0001NC | ICP analysis |
| | Water | 3005 | CP-IP-0003NC | Water ICP Prep |
| | | 7470A | CPMT0005NC | Mercury Water Analysis |
| Metals - GFAA | Water | 7060/7740 | NC-MT-0002 | GFAA analysis |
| | Water | 3020 | LM-WALN-2500 | Water GFAA Prep |
| | Water | 7060/7740 | NC-IP-0002 | As & Se Prep |
| Metals - Mercury | Water | 7470 | NC-MT-0004 | Water Mercury |
| Organic Prep | Water | 3500 series | CPCP0001NC | Organic Preparations |
| Organic Cleanup | Water | 3620 | NCOP0014 | Silica Gel/Florsil |
| | Water | 3650 | NCOP0013 | Sulfuric Acid |
| | Water | 3650 | NCOP0015 | Acid Base Partition |
| | Water | 3660 | NCOP0011 | Mercury |
| | Water | 3660 | NCOP0012 | TBA |

*The most current version of this SOP will be followed at the time of preparation/analysis.

Table 7 ***Chemical Analyses to be Conducted on Samples Collected at the Site***

| Volatile Organics Method 8260 | Quantitation Limits (a) (ug/L) | MCL (ug/L) |
|--|---|-----------------------|
| Acetone | 10 | n/a |
| Acetonitrile | 20 | n/a |
| Acrolein | 20 | n/a |
| Acrylonitrile | 20 | n/a |
| Benzene | 1 | 5 |
| Bromodichloromethane | 1 | n/a |
| Bromoform | 1 | n/a |
| Bromomethane | 1 | n/a |
| 2-Butanone (MEK) | 10 | n/a |
| Carbon disulfide | 1 | n/a |
| Carbon tetrachloride | 1 | 5 |
| Chlorobenzene | 1 | 100 |
| Chloroprene | 2 | n/a |
| Dibromochloromethane | 1 | n/a |
| Chloroethane | 1 | n/a |
| Chloroform | 1 | n/a |
| Chloromethane | 1 | n/a |
| Allyl Chloride | 2 | n/a |
| 1,2-Dibromo-3-chloropropane | 2 | 0.2 |
| 1,2-Dibromomethane (EDB) | 1 | 0.05 |
| Dibromomethane | 1 | n/a |
| trans-1,4-Dichloro-2-butane | 1 | n/a |
| Dichlorodifluoromethane | 1 | n/a |
| 1,1-Dichloroethane | 1 | n/a |
| 1,2-Dichloroethane | 1 | 5 |
| trans-1,2-Dichloroethene | 1 | n/a |
| 1,1-Dichloroethene | 1 | n/a |
| 1,2-Dichloropropane | 1 | 5 |
| cis-1,3-Dichloropropene | 1 | n/a |
| trans-1,3-Dichloropropene | 1 | n/a |

Table 7**Chemical Analyses to be Conducted on Samples Collected at the Site**

| Volatile Organics Method 8260 | Quantitation Limits (a) (ug/L) | MCL (ug/L) |
|--|---|-----------------------|
| 1,4-Dioxane | 200 | n/a |
| Ethylbenzene | 1 | 700 |
| Ethyl methacrylate | 1 | n/a |
| 2-Hexanone | 10 | n/a |
| Iodomethane | 1 | n/a |
| Isobutyl alcohol | 50 | n/a |
| Methacrylonitrile | 2 | n/a |
| Methylene chloride | 1 | n/a |
| Methyl methacrylate | 2 | n/a |
| 4-Methyl-2-pentanone (MIBK) | 10 | n/a |
| Propionitrile | 4 | n/a |
| Styrene | 1 | n/a |
| 1,1,1,2-Tetrachloroethane | 1 | n/a |
| 1,1,2,2-Tetrachloroethane | 1 | n/a |
| Tetrachloroethene | 1 | n/a |
| Toluene | 1 | 1000 |
| 1,1,1-Trichloroethane | 1 | 200 |
| 1,1,2-Trichloroethane | 1 | 5 |
| Trichloroethene | 1 | n/a |
| Trichlorofluoromethane | 1 | n/a |
| 1,2,3-Trichloropropane | 1 | n/a |
| Vinyl acetate | 2 | n/a |
| Vinyl chloride | 1 | 2 |
| Xylenes (total) | 2 | 10000 |
| Phenol | 1 | n/a |
| bis (2-Chloroethyl) ether | 1 | n/a |
| 2-Chlorophenol | 1 | n/a |
| 1,3-Dichlorobenzene | 1 | n/a |
| 1,4-Dichlorobenzene | 1 | n/a |
| 1,2-Dichlorobenzene | 1 | n/a |
| 2-Methylphenol | 1 | n/a |
| 4-Methylphenol | 1 | n/a |

Table 7 **Chemical Analyses to be Conducted on Samples Collected at the Site**

| Semivolatile Organics Method 8270 | Quantitation Limits (a) (ug/L) | MCL (ug/L) |
|--|---|-----------------------|
| N-Nitrosodi-n-propylamine | 1 | n/a |
| Hexachloroethane | 1 | n/a |
| Nitrobenzene | 1 | n/a |
| Isophorone | 1 | n/a |
| 2-Nitrophenol | 2 | n/a |
| 2,4-Dimethylphenol | 2 | n/a |
| bis (2-Chloroethoxy) methane | 1 | n/a |
| 2,4-Dichlorophenol | 2 | n/a |
| 1,2,4-Trichlorobenzene | 1 | n/a |
| Naphthalene | 0.2 | n/a |
| 4-Chloroaniline | 2 | n/a |
| Hexachlorobutadiene | 1 | n/a |
| 4-Chloro-3-methylphenol | 2 | n/a |
| 2-Methylnaphthalene | 1 | n/a |
| Hexachlorocyclopentadiene | 10 | 50 |
| 2,4,6-Trichlorophenol | 5 | n/a |
| 2,4,5-Trichlorophenol | 5 | n/a |
| 2-Chloronaphthalene | 1 | n/a |
| 2-Nitroaniline | 2 | n/a |
| Dimethyl phthalate | 1 | n/a |
| Acenaphthylene | 0.2 | n/a |
| 2,6-Dinitrotoluene | 5 | n/a |
| 3-Nitroaniline | 2 | n/a |
| Acenaphthene | 0.2 | n/a |
| 2,4-Dinitrophenol | 2 | n/a |
| 4-Nitrophenol | 5 | n/a |
| Dibenzofuran | 1 | n/a |
| 2,4-Dinitrotoluene | 5 | n/a |
| Diethyl phthalate | 1 | n/a |
| 4-Chlorophenyl phenyl ether | 2 | n/a |
| Fluorene | 0.2 | n/a |
| 4-Nitroaniline | 2 | n/a |

Table 7 **Chemical Analyses to be Conducted on Samples Collected at the Site**

| Semivolatile Organics Method 8270 | Quantitation Limits (a) (ug/L) | MCL (ug/L) |
|--|---|-----------------------|
| 4,6-Dinitro-2-methylphenol | 5 | n/a |
| N-Nitrosodiphenylamine | 1 | n/a |
| 4-Bromophenyl phenyl ether | 2 | n/a |
| Phenanthrene | 0.2 | n/a |
| Anthracene | 0.2 | n/a |
| Di-n-butyl phthalate | 1 | n/a |
| Fluoranthene | 0.2 | n/a |
| Pyrene | 0.2 | n/a |
| Butyl benzyl phthalate | 1 | n/a |
| 3,3-Dichlorobenzidine | 5 | n/a |
| Benzo(a)anthracene | 0.2 | n/a |
| Chrysene | 0.2 | n/a |
| bis(2-Ethylhexyl) phthalate | 2 | n/a |
| Di-n-octyl phthalate | 1 | n/a |
| Benzo (b) fluoranthene | 0.2 | n/a |
| Benzo (k) fluoranthene | 0.2 | n/a |
| Benzo (a) pyrene | 0.2 | n/a |
| Indeno (1,2,3-cd) pyrene | 0.2 | n/a |
| Dibenz (a,h) anthracene | 0.2 | n/a |
| Benzo (ghi) perylene | 0.2 | n/a |
| Phenol | 1 | n/a |
| bis (2-Chloroethyl) ether | 1 | n/a |
| 2-Chlorophenol | 1 | n/a |
| 1,3-Dichlorobenzene | 2 | n/a |
| 1,4-Dichlorobenzene | 1 | n/a |
| 1,2-Dichlorobenzene | 1 | n/a |
| 2-Methylphenol | 1 | n/a |
| 4-Methylphenol | 1 | n/a |
| N-Nitrosodi-n-propylamine | 1 | n/a |
| Hexachloroethane | 1 | n/a |
| Nitrobenzene | 1 | n/a |
| Isophorone | 1 | n/a |

Table 7

Chemical Analyses to be Conducted on Samples Collected at the Site

| Semivolatile Organics Method 8270 | Quantitation Limits (a) (ug/L) | MCL (ug/L) |
|--------------------------------------|--------------------------------------|---------------|
| 2-Nitrophenol | 2 | n/a |
| 2,4-Dimethylphenol | 2 | n/a |
| bis (2-Chloroethoxy) methane | 1 | n/a |
| 2,4-Dichlorophenol | 5 | n/a |
| 1,2,4-Trichlorobenzene | 1 | n/a |
| Naphthalene | 0.2 | n/a |
| 4-Chloroaniline | 2 | n/a |
| Hexachlorobutadiene | 1 | n/a |
| 4-Chloro-3-methylphenol | 2 | n/a |
| 2-Methylnaphthalene | 0.2 | n/a |
| Hexachlorocyclopentadiene | 10 | 50 |
| 2,4,6-Trichlorophenol | 5 | n/a |
| 2,4,5-Trichlorophenol | 5 | n/a |
| 2-Chloronaphthalene | 1 | n/a |
| 2-Nitroaniline | 2 | n/a |
| Dimethyl phthalate | 1 | n/a |
| Acenaphthylene | 0.2 | n/a |
| 2,6-Dinitrotoluene | 5 | n/a |
| 3-Nitroaniline | 2 | n/a |
| Acenaphthene | 0.2 | n/a |
| 2,4-Dinitrophenol | 5 | n/a |
| 4-Nitrophenol | 5 | n/a |
| Dibenzofuran | 1 | n/a |
| 2,4-Dinitrotoluene | 5 | n/a |
| Diethyl phthalate | 1 | n/a |
| 4-Chlorophenyl phenyl ether | 2 | n/a |
| Fluorene | 0.2 | n/a |
| Total Metals/TCLP Metals | | |
| Arsenic | 10 | 10 |
| Barium | 10 | 2000 |
| Cadmium | 1 | 5 |
| Chromium | 10 | 100 |

Table 7 ***Chemical Analyses to be Conducted on Samples Collected at the Site***

| | | |
|----------|-----|-----|
| Cobalt | 5 | n/a |
| Lead | 10 | 15 |
| Mercury | 0.2 | 2 |
| Nickel | 10 | n/a |
| Selenium | 15 | 50 |
| Silver | 5 | 100 |

- a. Specific quantitation limits are highly matrix dependent. The limits listed herein are provided for guidance and may not always be achievable.
 - b. Quantitation limits listed for solids are based on wet weight. The quantitation limits calculated by the laboratory for solids, calculated on dry weight basis, will be higher.
- (1) Specific quantitation limits (QL) are highly matrix dependent. The detection limits listed here may not always be achievable. QLs listed for solids are based on wet weight. The QLs calculated by the laboratory for solids, calculated on dry weight basis, will be higher.

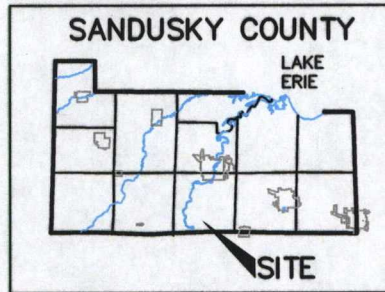
Table 8 *Analytical Methods, Number of Samples, and Analyses*

| Sampling Event | Groundwater Samples | Parameter | Method | Number of Field QC Samples | Number of Trip Blanks | Total Number of Samples |
|--|---------------------|---|------------------------------|-------------------------------|-----------------------------|----------------------------------|
| Fourth Quarter 2006 (October, November, or December) | MW-1 through MW-14 | VOC SVOC Priority Pollutant Metals (Filtered and Non- Filtered) | 8260B 8270C 6010B/7470 | 2 | 1 | 17 |
| Third Quarter 2007 (July, August, or September) | MW-1 through MW-14 | VOC SVOC Priority Pollutant Metals (Filtered and Non- Filtered) | 8260B 8270C 6010B/7470 | 2 | 1 | 17 |
| Third Quarter 2008 (July, August, or September) | MW-1 through MW-14 | VOC SVOC Priority Pollutant Metals (Filtered and Non- Filtered) | 8260B 8270C 6010B/7470 | 2 | 1 | 17 |
| Third Quarter 2009 (July, August, or September) | MW-1 through MW-14 | VOC SVOC Priority Pollutant Metals (Filtered and Non- Filtered) | 8260B 8270C 6010B/7470 | 2 | 1 | 17 |
| Third Quarter 2010 (July, August, or September) | MW-1 through MW-14 | VOC SVOC Priority Pollutant Metals (Filtered and Non- Filtered) | 8260B 8270C 6010B/7470 | 2 | 1 | 17 |

Figures



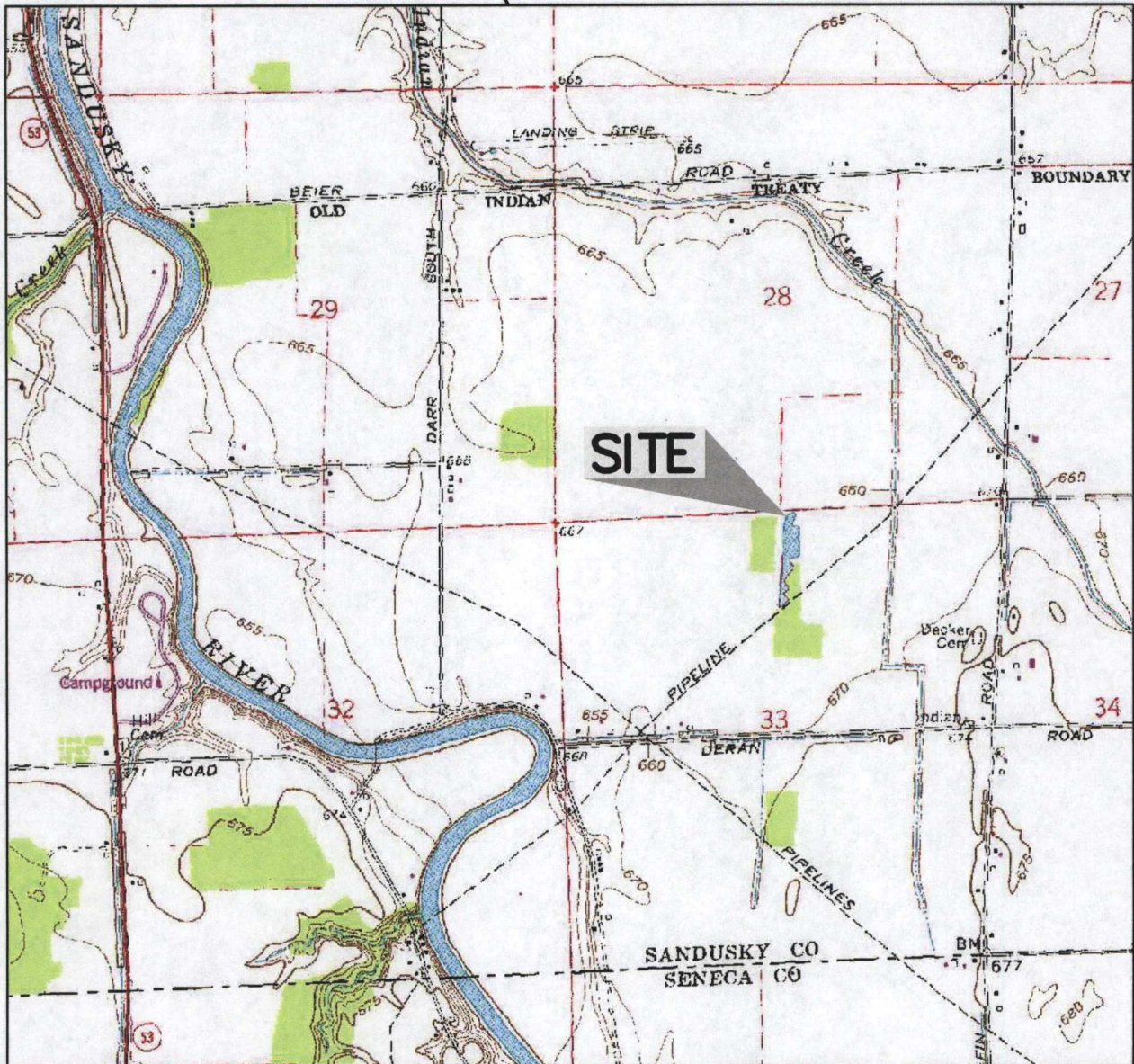
OHIO



SECTION 33
T.4N. - R.15E.
BALLVILLE TOWNSHIP
SANDUSKY COUNTY
FREMONT, OHIO



0 2000
SCALE (IN FEET)



SITE LOCATION MAP

ADAPTED FROM USGS
FREMONT WEST/1980

REVISIONS ARE TO BE MADE ON THE CADD FILE ONLY



Drawn By
FAK 5/20/05

LUBRIZOL
GREINER'S LAGOON SITE
FREMONT, OHIO

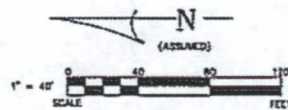
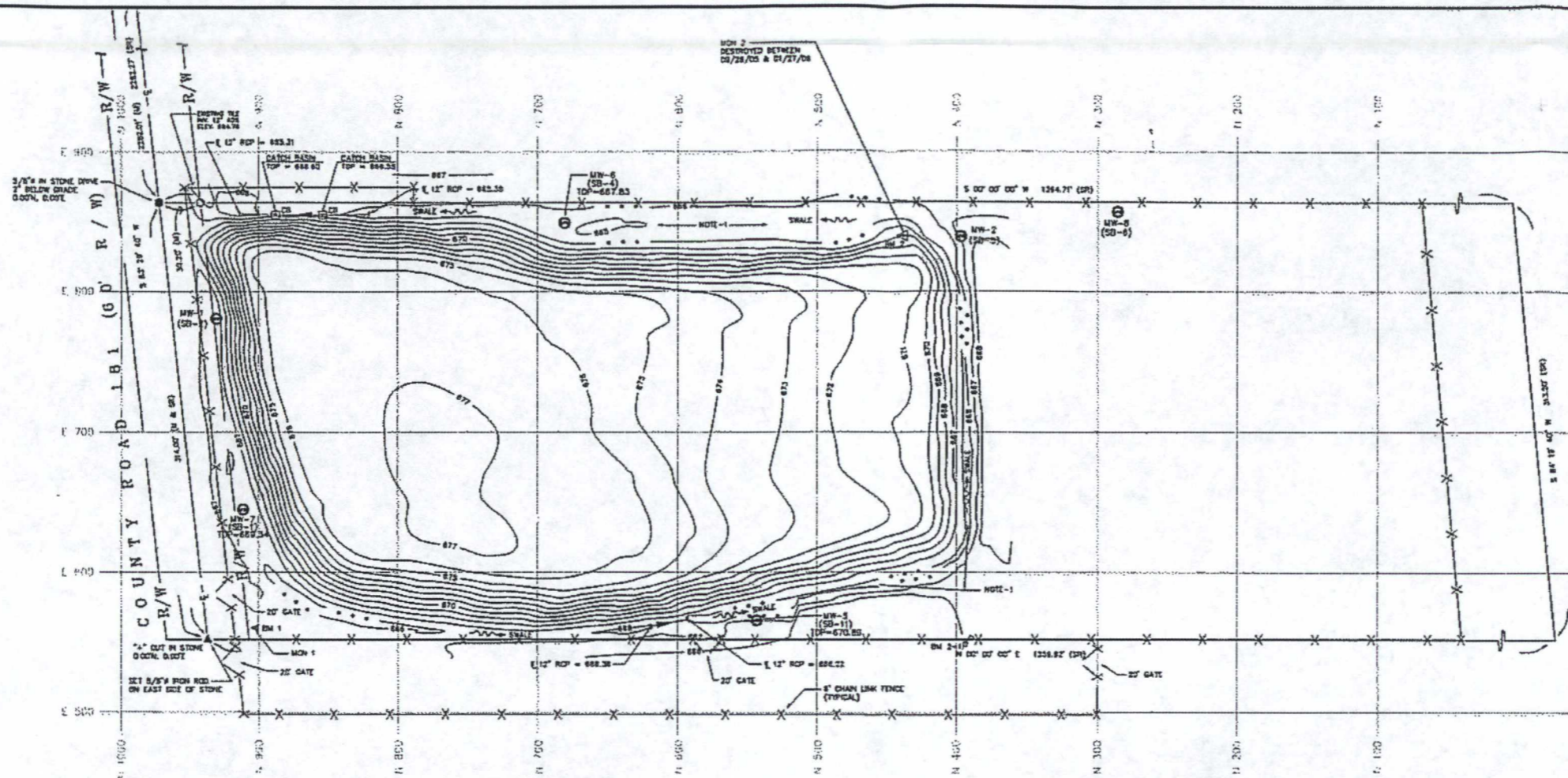
Environmental Resources Management

CADD Review

CHK'D

0004100

FIGURE 1



| DESCRIPTION |
|---------------------------------|
| CENTER LINE/BASELINE |
| RIGHT-OF-WAY LINE |
| PROPERTY LINE |
| BUILDING |
| SECTION LINE |
| EDGE OF PAVEMENT |
| DRIVE OR SIDEWALK |
| FENCE LINE (SPECIFY TYPE) |
| MANHOLE |
| CATCH BASIN, YARD BASIN |
| VALVE (TYPE SPECIFIED) |
| METER (TYPE SPECIFIED) |
| ELDER INLET W/COVER |
| WELL (TYPE SPECIFIED) |
| STORM SEWER (W/ SIZE & TYPE) |
| SANITARY SEWER (W/ SIZE & TYPE) |
| WATERLINE (W/ SIZE & TYPE) |
| PETROLEUM LINE (W/ SIZE & TYPE) |
| FIRE HYDRANT |
| DITCH (W/ TOP & BOTTOM) |
| SURFACE WATER DIRECTION |
| CLEARCUT |
| CONTOUR LINE |

| EXISTING | PROPOSED |
|----------|----------|
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |

| DESCRIPTION |
|---------------------------------|
| UNDERGROUND OVERHEAD ELECTRIC |
| UNDERGROUND OVERHEAD TELEVISION |
| UNDERGROUND OVERHEAD TELEPHONE |
| MAIL BOX |
| ELECTRIC TRANSFORMER |
| POWER POLE (W/ OUT WIRE) |
| TELEPHONE POLE |
| LIGHT POLE |
| RAILROAD CROSSING SIGN |
| STOP SIGN |
| BRACK POLE |
| PIPELINE MARKER POST |
| ROCK SIGN (TYPE SPECIFIED) |
| TREE ON STUMP (W/ SIZE) |
| "X" TO BE REMOVED |
| EVERGREENS (W/ SIZE) |
| STREAM OR DITCH |
| SLOSH OR BRUSH ROW |
| TEST HOLE OR BORING (W/ NUMBER) |

| EXISTING |
|----------|
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |

| LEGEND |
|-------------|
| SET FUNDING |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |

NOTES:

- 1) THE SHALE FROM THE SOUTH END OF THE WEST CLAMET TO THE SOUTH END OF THE EAST CLAMET HAS BEEN REMOVED SINCE SEPTEMBER 22, 2005. THIS DRAWING DOES NOT REFLECT THIS CHANGE.
- 2) THE SIX FOOT CHAIN LINK FENCE ENCLOSURES ON:
 - A) COUNTY ROAD 181 RIGHT-OF-WAY.
 - B) PRIVATE PROPERTY TO THE EAST.
 - C) PRIVATE PROPERTY TO THE WEST.
- 3) BENCH MARK 2/MONUMENT 2 WAS DESTROYED BETWEEN SEPTEMBER 22, 2005 AND JANUARY 22, 2006.

I HEREBY DECLARE THAT THE ABOVE TOPOGRAPHICAL SURVEY WAS PERFORMED SEPTEMBER 2005 & JANUARY, 2006. ALL OBJECTS LOCATED AND ELEVATIONS SHOWN ARE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF.

THIS DOCUMENT WAS ORIGINALLY ISSUED BY JOHN M. MUSTERIC, 09-28-2005 AND WAS REVISED ON 02-18-2006. THIS DOCUMENT IS NOT CONSIDERED A SCALED DOCUMENT.

JOHN M. MUSTERIC, P.E. NO. 7829 DATE

TOPOGRAPHICAL PLAN: POST-CONSTRUCTION

| | |
|---|-------------------------|
| LUBRIZOL CONSTRUCTION RECORD DRAWINGS DREYER LADSON SITE FREMONT, OHIO | |
| Figure 2 - Site Plan | |
| DATE: 02/02/2006 | PROJECT NUMBER: 0004100 |
| SHEET: 1 | TOTAL SHEETS: 1 |
| Environmental Resources Management | |

Prepared by:
J. MUSTERIC & ASSOCIATES
 CONSULTING ENGINEERS and SURVEYORS
 303 SOUTH ARCH STREET FREMONT, OHIO 43420 419-355-8214